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PATENT SPECIFICATION



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389,858

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PROVISIONAL SPECIFICATION.

Improvements relating to Grab Buckets.

We, SYDNEY HERBERT PRIESTMAN, a British Subject, of Holderness Foundry, Hull, in the County of York, and STANLEY PRINCE, a British Subject, of Hillcrest, Swanland Road, Hessle, in the County of York, do hereby declare the nature of this invention to be as follows:—

In the operation of a grab for digging, discharging loads and like operations it is sometimes desirable to be able to control the angular position of the grab in the horizontal plane. This arises, for example, if the grab is being used for digging a trench or discharging a barge and in such cases it is not sufficient to provide means merely for keeping the grab in a definite angular relation to the jib of the crane because the angle between the jib and the line of the trench or the hold of the barge is continually varying. The same condition arises in the discharging of wagons and in many other cases, and it has been necessary hitherto to employ a person to take hold of the grab and turn it round into the required position.

The invention aims at providing a device whereby the operator who controls the crane and the grab can adjust the angular position of the grab in the horizontal plane at will without leaving his position in the crane cab. Accordingly, the invention consists of a controlling arrangement comprising two ropes attached to the grab on opposite sides and weighted to keep them taut under all conditions of operation of the grab, and a device under the control of the operator to which the two ropes are led and which when operated hauls in one of the ropes and pays out the other.

This device may consist of a beam pivoted at its centre and carrying pulleys at its ends around each of which one of the ropes is led, the two ropes passing over a pair of pulleys carried by the beam near its centre and being attached to a weight hanging freely from the ropes, this weight being sufficient to keep the two ropes tensioned adequately but being insufficient to swing the grab as a whole materially out of its position vertically beneath the jib-head. The beam has attached to it a hand-lever conveniently placed to be grasped

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by the operator, and by merely turning this hand-lever in one direction or the other he can, as will be evident, swing the grab at will through a considerable angular range. Alternatively, the two ropes, tensioned by a weight attached to their ends as before, may be led over two pairs of fixed pulleys and two movable pulleys, one for each rope, these movable pulleys having their spindles attached to ropes which are wound around a drum in opposite directions so that by turning the drum in one direction or another the loop around one movable pulley is lengthened and the loop around the other movable pulley is shortened, thereby swinging the grab in the desired direction. In both cases, of course, the only effect of the raising and lowering of the grab will be a corresponding raising or lowering of the weight without any alteration in the angular position of the grab, both ropes running over the pulleys at equal speeds.

In an embodiment of the invention suitable for mounting on the roof of the crane cab a frame consisting, for example, of angle-iron longitudinals suitably braced together, is fixed to the roof of the cab and carries at its rear end which overhangs the roof four pulleys mounted independently on the same spindle, and a guide-rod depending from the rear end of the frame is provided for the tensioning weight. Both ropes are attached to this weight and they pass over two inner pulleys then over two pulleys mounted on the upper ends of upstanding pivoted arms, one rope over each pulley then back to the two outer fixed pulleys and forwards again to the grab to which they are fixed on opposite sides. The upstanding pivoted arms are connected by links to opposite ends of a central pivoted beam which is normally vertical. By swinging this beam in one direction or another one of the pivoted arms is swung forwards and the other backwards, thus paying out one rope and hauling in the other as will readily be understood. Preferably, the movement of the beam is effected by a lever pivoted coaxially with the beam but independently thereof and carrying a pawl which engages between the teeth of a

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toothed-wheel fixed to the beam. This pawl is under the control of a hand-grip pivoted to the lever at its handle end so that the operator may engage or disengage the pawls with the teeth at will. The pawl may either be spring-pressed into engagement and disengage by pressing the hand-grip, or it may be urged out of engagement by a spring and engage with the teeth by pressure on the hand-grip. In either case the arrangement enables the operator to turn the toothed-wheel and therefore swing the beam in either direction by repeated to-and-fro operations of the hand-lever coupled with suitable manipulation of the hand-grip. The beam may be provided at each end with two or more holes at different distances from the pivot point so that the links may be pivoted to the beam at different radii, thus enabling the purchase to be varied. Instead of providing an entirely separate hand-lever one of the two upstanding pivoted arms may be extended downwards to serve as a hand-lever and the beam connected to the two arms by links serves merely as a device for transmitting the movement of the hand-lever, but reversed in direction, to

the other arm. Instead of a hand-lever, a hand-wheel and a worm and worm-wheel may be used for imparting motion to the pivoted arms.

If desired, an arrangement similar to that described for the roof of the cab may be mounted on the jib of the crane, the frame being, for example, attached to the underside of the jib with the four pulleys at the top and the arms carrying the movable pulleys extending downwardly and forwardly. In this case it is preferred to arrange the guides for the weight so that the weight slides along the length of the frame instead of vertically. A further desirable modification consists in placing the two pulleys from which the ropes lead directly to the grab, at the lower end of the frame instead of on the same spindle (at the top end of the frame) as the two pulleys from which the rope leads directly to the weight.

Dated the 25th day of September, 1931.

For the Applicants,

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#### COMPLETE SPECIFICATION.

##### Improvements relating to Grab Buckets.

We, SYDNEY HERBERT PRIESTMAN, a British Subject, of Holderness Foundry, Hull, in the County of York, and STANLEY PRINCE, a British Subject, of Hillcrest, Swanland Road, Hessle, in the County of York, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

In the operation of a grab for digging, discharging loads and like operations it is sometimes desirable to be able to control the angular position of the grab in the horizontal plane. This arises, for example, if the grab is being used for digging a trench or discharging a barge and in such cases it is not sufficient to provide means merely for keeping the grab in a definite angular relation to the jib of the crane because the angle between the jib and the line of the trench or the hold of the barge is continually varying. The same condition arises in the discharging of wagons and in many other cases, and it has been necessary hitherto to employ a person to take hold of the grab and turn it round into the required position.

The invention aims at providing a device whereby the operator who controls

the crane and the grab can adjust the angular position of the grab in the horizontal plane at will without leaving his position in the crane cab. Accordingly, the invention consists of a controlling arrangement comprising two ropes attached to the grab on opposite sides and weighted to keep them taut under all conditions of operation of the grab, and a device under the control of the operator to which the two ropes are led and which when operated hauls in one of the ropes and pays out the other.

This device may consist of a beam pivoted at its centre and carrying pulleys at its ends around each of which one of the ropes is led, the two ropes passing over a pair of pulleys carried by the beam near its centre and being attached to a weight hanging freely from the ropes, this weight being sufficient to keep the two ropes tensioned adequately but being insufficient to swing the grab as a whole materially out of its position vertically beneath the jib-head. The beam has attached to it a hand-lever conveniently placed to be grasped by the operator, and by merely turning this hand-lever in one direction or the other he can, as will be evident, swing the grab at will through a considerable

angular range. Alternatively, the two ropes are taken round pulleys on the weight and are then passed in opposite directions round two sheaves fixed to a shaft, the ropes being fixed at their ends to the peripheries of these sheaves. By turning the shaft in one direction or the other either rope may be hauled in and the other paid out, while the only effect of the raising and lowering of the grab will be a corresponding lowering or raising of the weight without any alteration in the angular position of the grab.

Various constructions according to this invention are illustrated in the accompanying drawings, in which

Figure 1 is a diagram showing a crane, a grab suspended therefrom and a schematic slewing gear which although not a preferred form of the invention, is well adapted to show its principles of operation,

Figure 2 is a diagram illustrating another form of the gear,

Figure 3 illustrates how the gear of Figure 2 may be conveniently mounted on the roof of the crane-cab,

Figure 4 illustrates a modification of the gear shown in Figures 2 and 3,

Figure 5 shows a gear similar to that of Figure 3 mounted on the crane-jib,

Figure 6 is a diagram showing another form of the gear,

Figure 7 is a further diagram showing the arrangement of Figure 6 modified for mounting on the crane-jib,

Figure 8 is a side elevation of this gear mounted on the crane-jib,

Figure 9 is an oblique plan of a part of Figure 8 looking in the direction of the arrow 9-9 in Figure 8,

Figures 10 and 11 illustrate a device applied to the grab-head which enables the slewing ropes to be led over a pulley near the jib-head instead of more or less horizontally between the grab-head and the foot of the crane, and

Figure 12 is a side elevation of a device whereby the slewing gear may be operated by power.

Referring to Figure 1, a grab 14 suspended from a crane-jib 16 is shown digging a narrow trench. As the digging progresses along the length of the trench the angular position of the grab in relation to the jib 16 must be varied, and in order to enable this to be done by the operator in the cab 18 of the crane ropes 20, 22 are attached to the grab, one to each jaw, as shown. These ropes are led over guide pulleys 24 in the cab and then over pulleys 26 mounted at opposite ends of a beam 28 fixed to the upper end of a vertical spindle 30 provided with a handle 32 by means of which it may be turned

by the operator. The ropes then pass over further pulleys 34 and are finally attached to a weight 36. It will readily be appreciated that if the beam 28 is swung in one direction or another the grab 14 will be turned in the horizontal plane, while when the grab is raised and lowered the weight 36 will rise or fall correspondingly without however disturbing the position in the horizontal plane to which the grab has been adjusted. It will be seen that the pulleys 26 deflect the two ropes 20, 22 and that the turning of the beam 28 causes the deflection of one rope to be increased and the deflection of the other rope decreased while both ropes are maintained tensioned by the weight. This increase or decrease of the deflection of the two ropes may be carried out in other ways which will now be described, and later on arrangements will be described in which the slewing effect is obtained not by varying the deflection in the two ropes but by directly hauling one in and paying the other out.

Referring now to Figure 2, the ropes 20, 22 are led round guide pulleys 24 and thence to pulleys 26 which instead of being mounted on the ends of a horizontal beam are mounted on the upper ends of vertical levers 38. From these pulleys 26 the ropes pass to further pulleys 34 and are attached to the weight 36. The pulleys in Figure 2 have been given the same reference numerals as those in Figure 1 to enable the analogy between the two constructions to be more readily appreciated. It will of course be understood that Figures 1 and 2 as well as Figures 6 and 7 later to be described are diagrammatic in character and certain details shown would be varied in the actual construction, for example, the two ropes would be attached to the weight at a single point, or at any rate, at points much closer together than illustrated. If the two levers 38 are swung in opposite directions, for example, into the positions shown in dotted lines, it will be seen that the amount by which one rope is deflected is increased and the amount by which the other is deflected is decreased, thus in effect hauling in one rope and paying out the other exactly as described with reference to Figure 1.

Figure 3 shows a device according to Figure 2 mounted on the roof of the crane-cab. The levers 38 are connected by links 40 to opposite ends of a beam 42 carried on a spindle 44 to which is attached a toothed wheel 46. A hand lever 48 is mounted loosely on the spindle 44 and carries a pivoted pawl 50 connected by a rod 52 to a spring-pressed hand grip 54, the spring being so arranged as to tend to move the pawl 50 out of

engagement with the toothed wheel 46. In order to slew the grab the operator grips the hand-grip thereby engaging the pawl 50 with the teeth of the wheel 46 and swings the hand-lever in one direction or the other. If the movement imparted by one swing is not sufficient the operator releases the grip 54, moves the hand-lever back to its normal position, re-engages the pawl and swings the lever again in the desired direction. In this form of the device the weight 36 is guided on a vertical rod 56 extending between the rear end of the angle-iron base 58 of the device and a bracket 60 attached to the rear wall of the cab.

Figure 4 illustrates in perspective a modified form of this arrangement in which one of the levers 38 has a downward extension 39 serving as a hand-lever and the links 40 connect the two levers to opposite ends of an idle beam 43 which ensures that the two levers 38 shall move in opposite directions.

In Figure 5 a device of the same character as that described with reference to Figure 3 is shown applied to the jib of the crane, the weight 36 instead of hanging vertically being guided in guideways 62 forming the main frame of the device and bolted to the underside of the jib. The mechanism itself is the same as that shown in Figures 2 and 3 except that the pulleys 34 are at the upper end of the frame 62 instead of being co-axial with the pulleys 24, and that the spindle 44 is transferred to the lower end of the frame 62 and carries the guide pulleys 24.

A modification will now be described in which the ropes 20, 22 are directly hauled in or paid out. The principle of this modification will be clear from a consideration of Figure 6 in which the ropes first pass over guide pulleys 24 and then around pulleys 64 mounted on the weight 36. From these pulleys the ropes pass in opposite directions around sheaves 66 and are attached thereto as shown. The sheaves 66 are fixed to the spindle 68 on which the guide pulleys 24 rotate idly, and it will be appreciated that if the spindle 68 is rotated in one direction or another one rope will be paid out and the other hauled in, while the weight 36 will maintain the ropes tensioned and will ascend or descend during the raising and lowering of the grab.

In applying the principle of Figure 6 to an actual arrangement mounted on the crane jib the modifications shown diagrammatically in Figure 7 and in detail in Figures 8 and 9 are required. The weight 36 is mounted to slide on the guides 62 as in Figure 5, the guide-pulleys 24

are mounted on a separate spindle below the spindle 68, and from these pulleys the ropes pass around pulleys 70 mounted at the upper end of the frame 62, then around the pulleys 64 and finally around further guide-pulleys 72 before passing to the sheaves 66. It will be recognised that these changes are matters of detail only and that the operation of the device of Figures 7—9 is precisely the same as that of the device shown in Figure 6. The spindle 68 carries a toothed wheel 47 engaged by a spring-pressed pawl 51 actuated through a bell-crank 74 and rod 53 by means of a hand-grip 55 mounted on the hand-lever 49. This hand-lever 49 is pivoted to the free end of a lever 76 pivoted on the spindle 68 and carrying the pawl. The hand-lever 49 thus operates in the manner of a link by which the lever 76 can be swung in one direction or the other to turn the spindles 68 just as the spindle 44 of Figures 2, 3 and 5 is turned by the hand-lever 48.

In the arrangements so far described the ropes 20, 22 pass directly from the grab to the foot of the crane. This would be inconvenient in some cases, as for example in operating a grab inside the hold of a ship, because the ropes would pass over the hatch-combing and from there to the grab they would be more or less vertical and would not be disposed to slew the grab effectively. Figure 10 and 11 illustrate an arrangement whereby this disadvantage may be overcome.

A pulley 78 is attached to the grab-head with its axis vertical, and on the spindle of this pulley there is mounted to swing freely a triangular frame 80 which carries two pulleys 82. Near the head of the jib 16 there are two further pulleys 84 over which the ropes 20, 22 are led. From these pulleys the ropes pass downwards around the pulleys 82 and then around the pulley 78 to which they are attached at 86. It will be readily seen that the tension in the ropes exerted by the weight 36 will tend to keep the frame 80 in a symmetrical position such as is shown in the drawings, and that when the ropes 20, 22 are operated as previously described the tendency will be for the pulley 78 to rotate carrying the grab with it, and although the frame 80 will deviate slightly from the position shown during the operation the final result will be that the grab will be turned and the frame 80 will resume its neutral position.

Any of the arrangements above described may be operated by power instead of by hand if desired, and Figure 12 illustrates an arrangement for this purpose. The spindle 44, Figures 2, 3 and 5, or

the spindle 68, Figures 7, 8 and 9, carries a drum (not shown) around which a rope 88 is wound. This rope passes over guide pulleys 90 to a drum 92; the two ends of the rope being led in opposite directions over this drum 92 and fixed thereto. If the drum 92 is rotated in one direction or the other the drum on the spindle 44 or 68, as the case may be, will also be rotated. Fixed to the drum 92 is a toothed wheel 94 with which co-operate two pawls 96. These pawls are pivoted to a lever 98 pivoted at 100 and provided with a slot 102 in which engages a crank-pin 104 fixed to the power driven shaft 106. The crank-pin will continually oscillate the lever 98 about its pivot-point 100. Links 108 are pivoted to the pawls 96 and led through holes in a guide-plate 110 fixed to the lever 98. At their extremities these links carry stops 112 and compression springs 114 are interposed between these stops and the guide-plate 110. These springs normally serve to maintain the pawls 96 out of engagement with the toothed wheel 94. The hand-lever 116 is provided with two rounded projections 118 bearing against the stops 112, and it will be seen that by manipulating the hand-lever either of the links 108 can be moved to the right, thereby enabling the other one to move to the left under the influence of its spring 114, thereby bringing one pawl 96 or the other at will into engagement with the wheel 94. Thus, so long as the lever 116 is held in such a position the drum 92, and therefore the spindle 44, 68, will be turned step-by-step in one direction or the other.

A friction brake (not shown) is preferably applied to the drum 92 in order that when neither end of the pawl is in engagement with the wheel 94 any tendency on the part of the grab to swing shall not oscillate the drum. Alternatively, an irreversible connection such as a worm and worm-wheel may be interposed between the ratchet wheel and the drum. Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. An apparatus for enabling the angular position of a grab to be controlled from a distant point, comprising two ropes attached to the grab on opposite sides and weighted to keep them taut under all conditions of operation of the grab, and a device under the control of the operator to which the two ropes are led and which when operated hauls in one of the ropes and pays out the other.

2. Apparatus according to Claim 1

wherein both ropes are attached to a single weight, and the device for hauling in one of the ropes and paying out the other comprises two pulleys each engaging and deflecting one of the ropes and movable in such a manner that the amount of deflection of one of the ropes is increased and the amount of deflection of the other rope is decreased.

3. Apparatus according to Claim 2 wherein the deflecting pulleys are carried by levers constrained to swing equally and oppositely and provided with means under manual control for swinging them in either direction.

4. Apparatus according to Claim 3 wherein the levers are connected by means of links to opposite ends of the balance beam to which is secured a toothed-wheel, and a hand-lever is provided which pivots freely about the axis of the wheel and is furnished with a pawl which can be engaged with or disengaged from the toothed-wheel at will.

5. Apparatus according to Claim 4 wherein the mechanism comprising the pulley-carrying levers, the balance beam and the toothed wheel is mounted on the roof of a cab of a crane which operates the grab and the weight is guided vertically at the back of the cab.

6. Apparatus according to Claim 4 wherein the mechanism comprising the pulley-carrying levers, the balance beam and the toothed wheel is mounted on the underside of the jib of the crane which operates the grab, and the weight is mounted to slide in guides lengthwise of the jib.

7. Apparatus according to Claim 1 wherein both ropes are led around pulleys mounted on a single weight and means are provided for directly hauling in one rope and paying out the other.

8. Apparatus according to Claim 7 wherein the ropes are led in opposite directions around a drum or sheave and fixed thereto, whereby the rotation of the drum or sheave in one direction or the other will directly haul in one rope and pay out the other.

9. Apparatus according to any preceding claim wherein the ropes are led around and attached to a pulley arranged with its axis vertical and fixed to the grab-head and from that pulley led upwardly around two pulleys mounted on a horizontal axis in a frame (for example 80) pivoted about the vertical axis of the pulley for the purpose described.

10. In combination with apparatus according to any preceding claim, a device for hauling in and paying out the ropes by power-operated means comprising a toothed wheel (for example 94) opera-

tively connected to the hauling means,  
two pawls pivoted to a lever and normally  
held in such a position that neither of  
them is in engagement with the toothed  
5 wheel, power-operated means for oscillat-  
ing the lever continually, and manual  
means for causing one pawl or the other  
to engage with the toothed wheel.

Dated this 23rd day of June, 1932.

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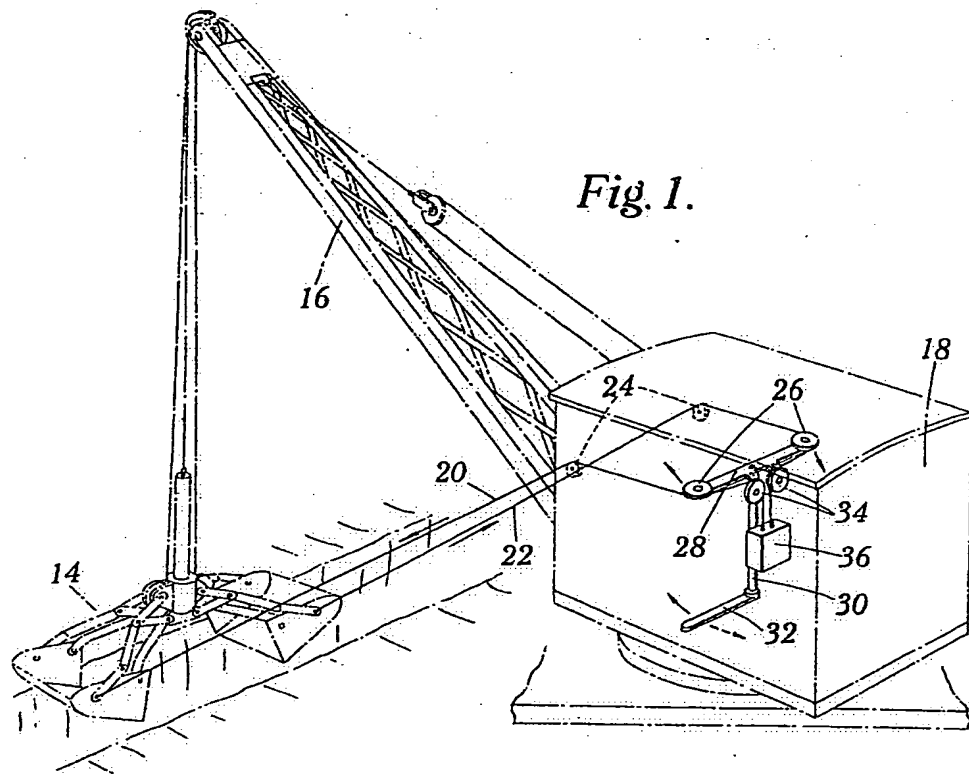


Fig. 1.

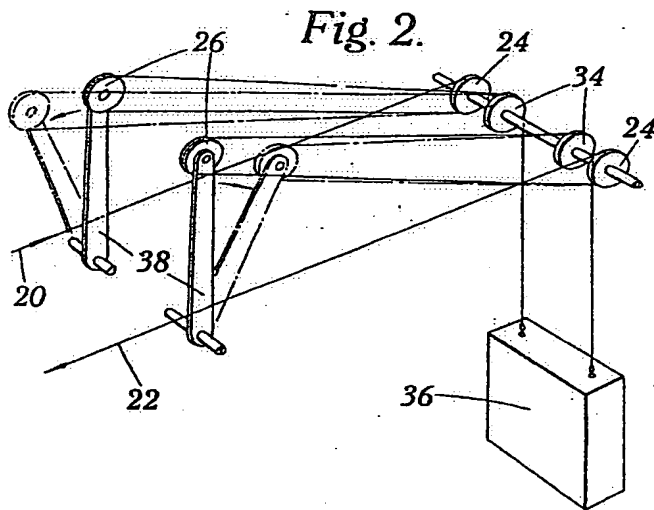


Fig. 2.

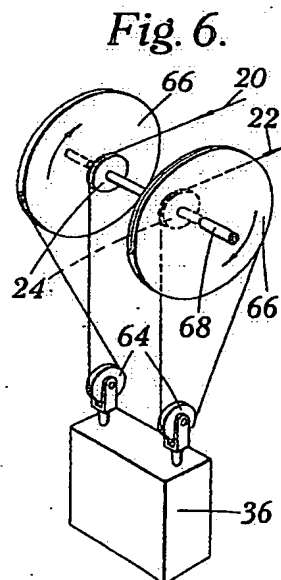


Fig. 6.

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Fig. 3.

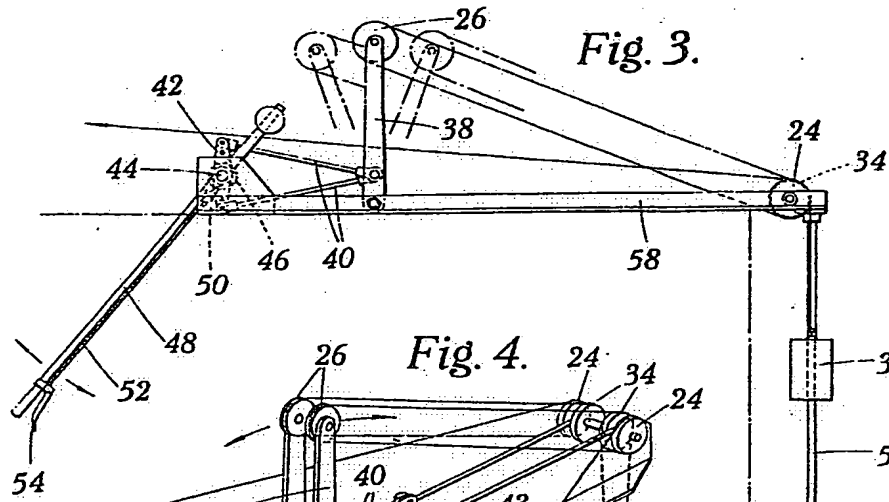


Fig. 4.

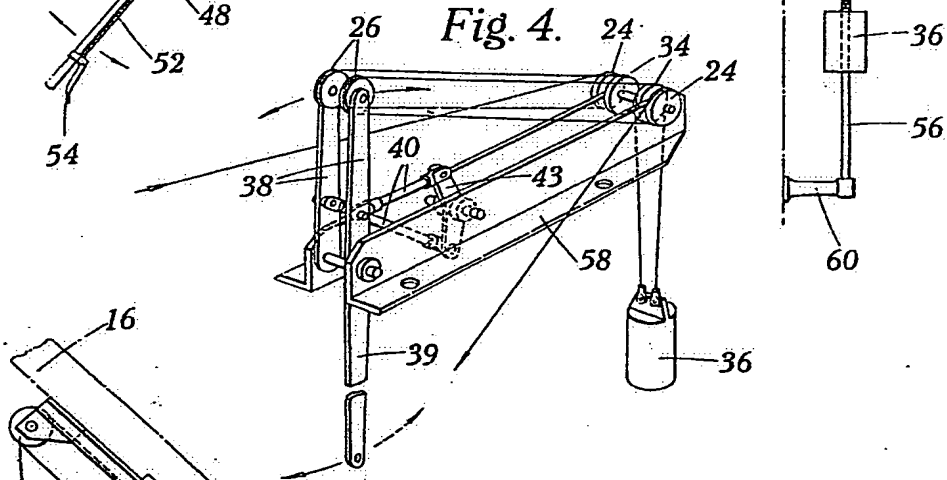
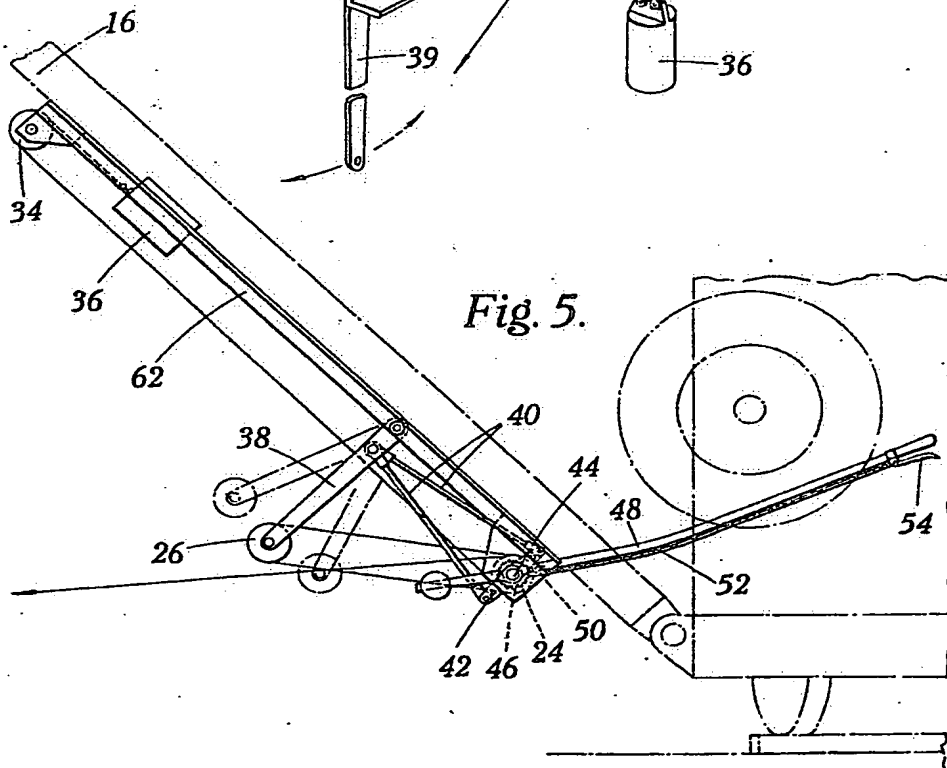


Fig. 5.





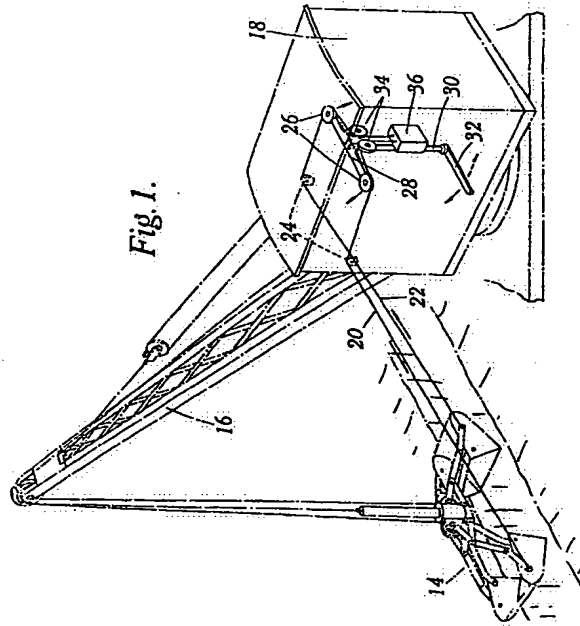


Fig. 1.

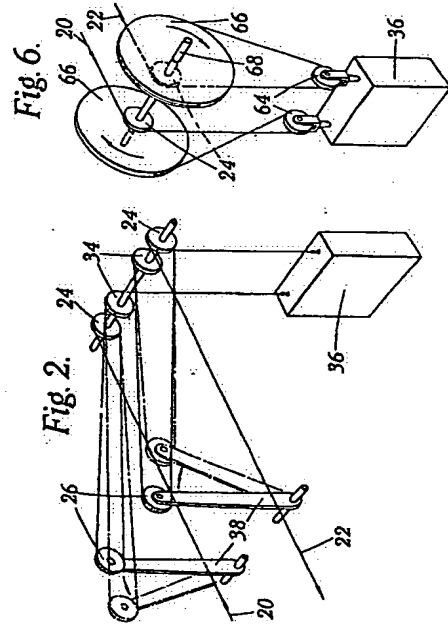


Fig. 2.

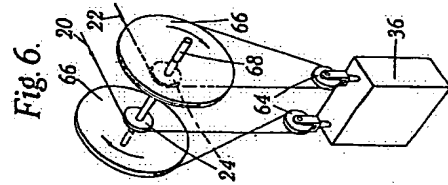


Fig. 6.

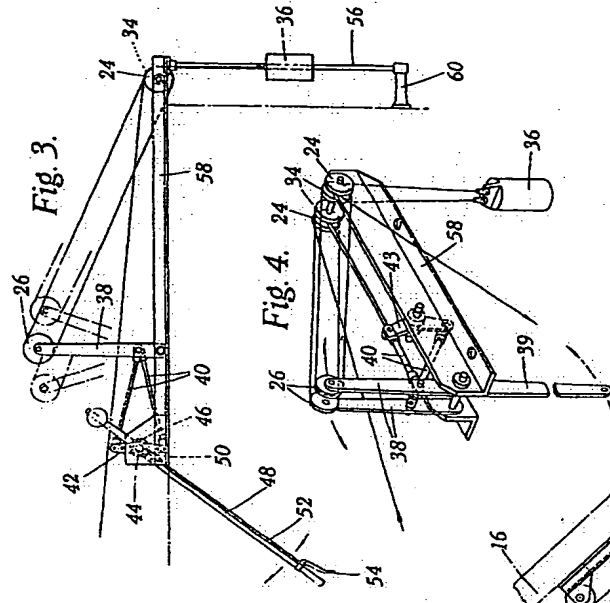


Fig. 3.

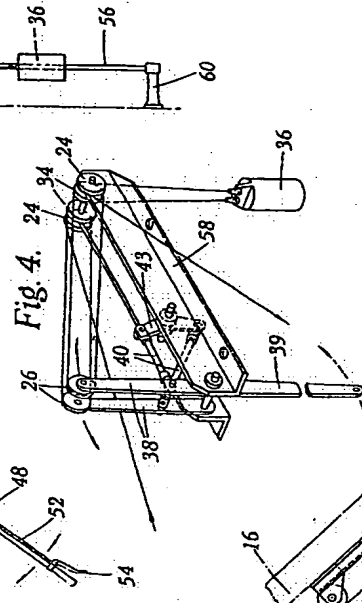


Fig. 4.

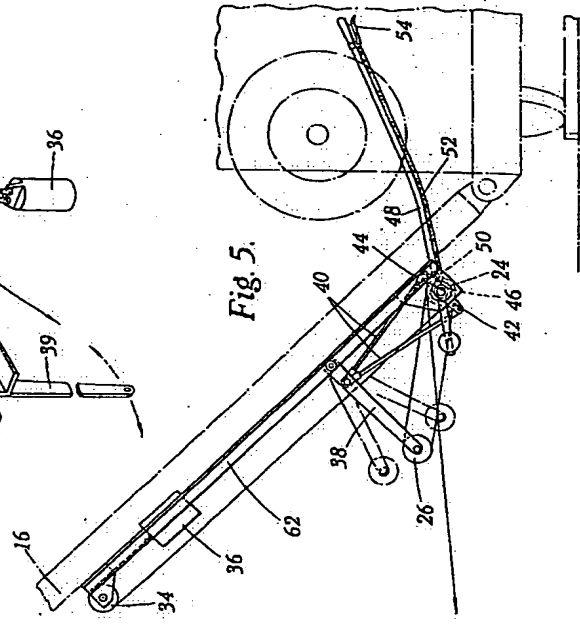


Fig. 5.

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Fig. 7.

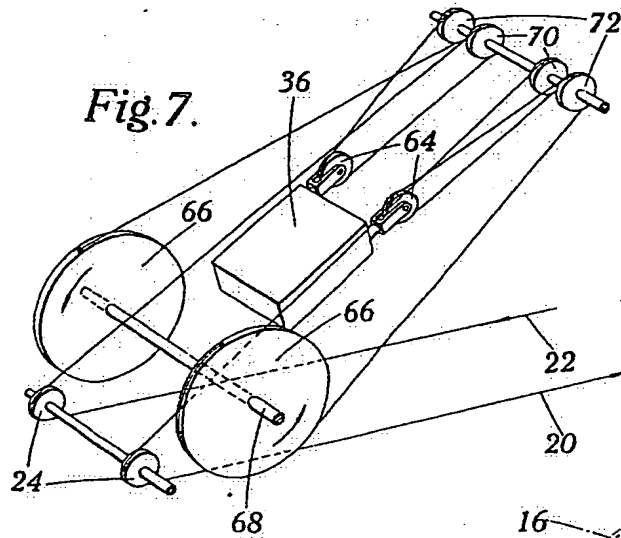


Fig. 8.

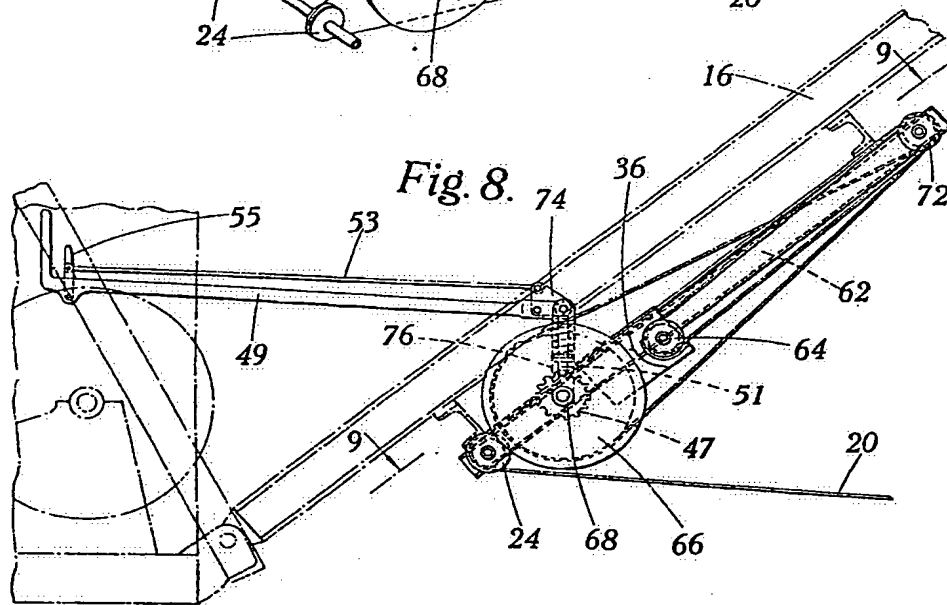
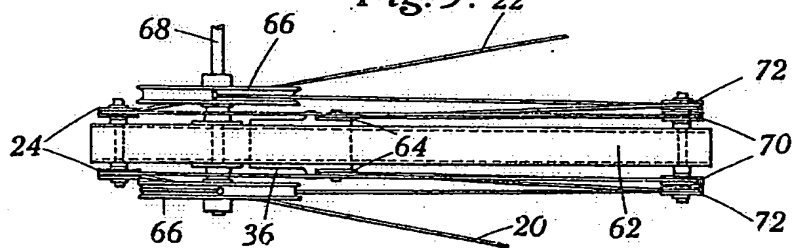
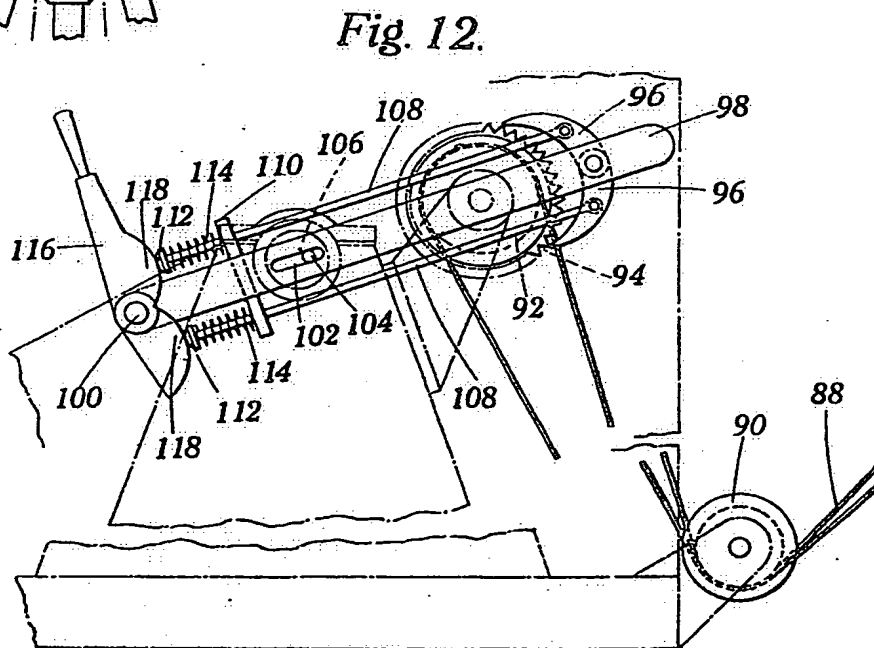
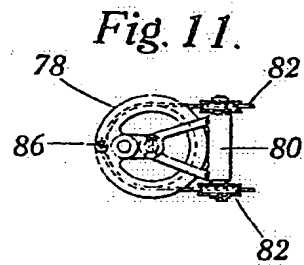
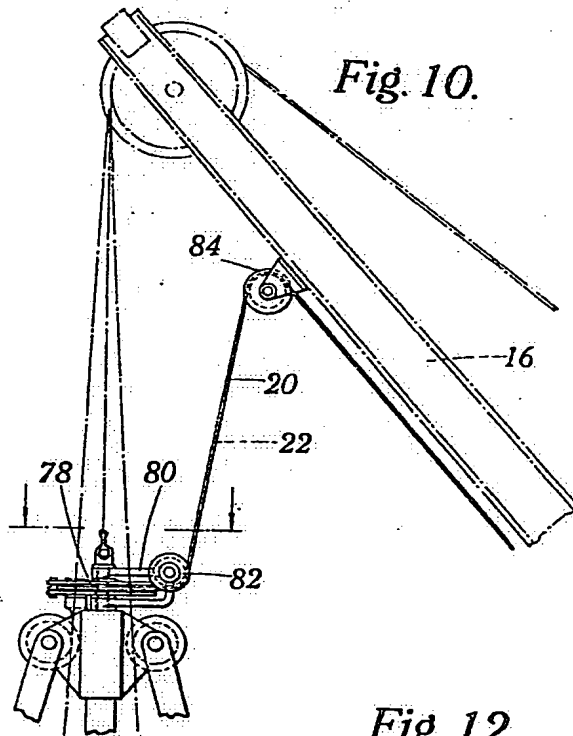
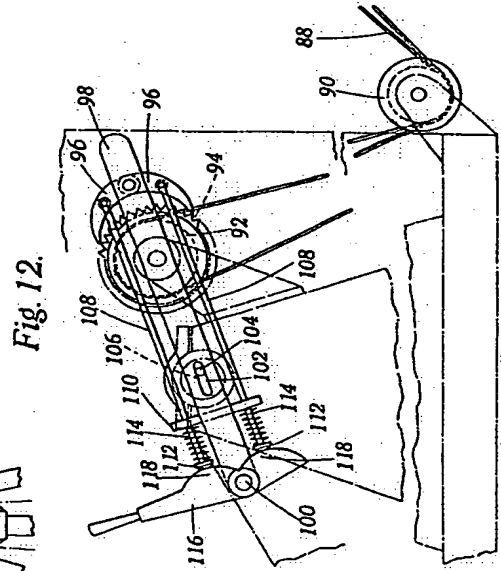
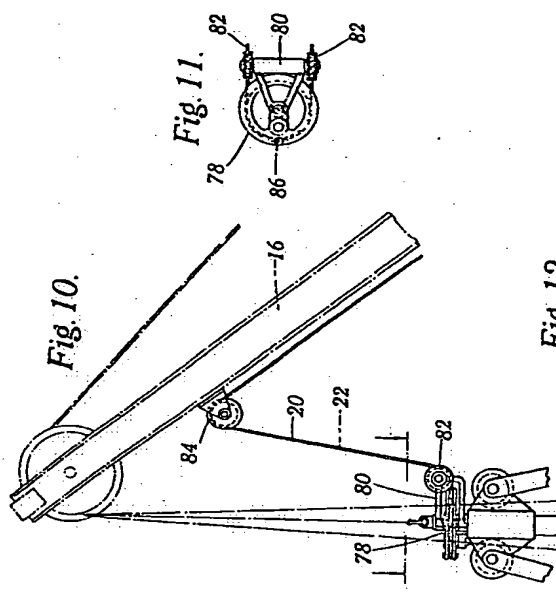
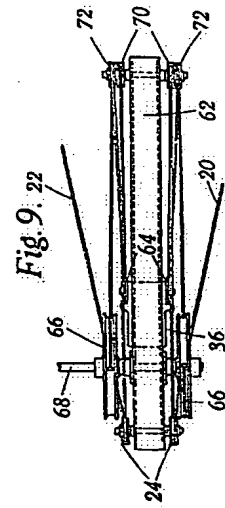
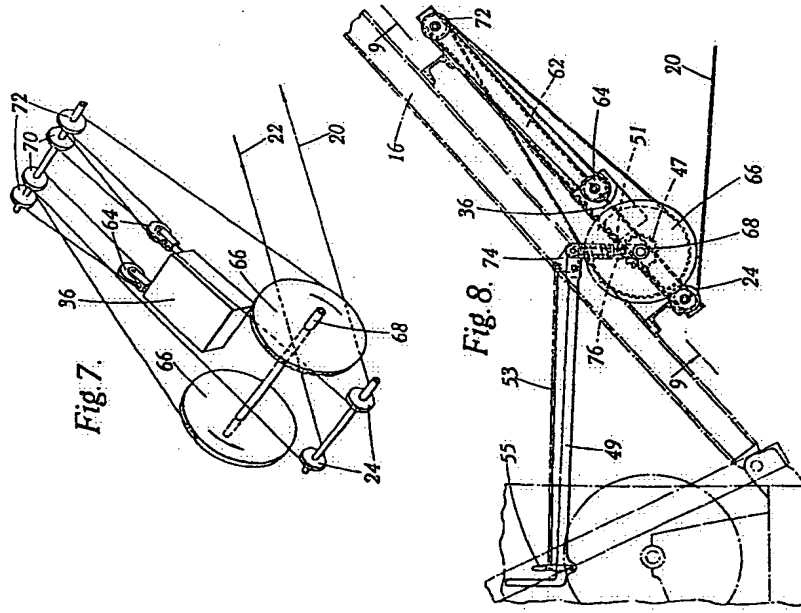


Fig. 9.







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